SPECIES RICHNESS AND ABUNDANCE OF LARGE MAMMALS IN ZARANINGE FOREST, COAST REGION, TANZANIA

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ABSTRACT

A study on the large mammals of Zaraninge Forest was conducted using the line transect method between 1995 and 2001. They comprised 16 species from 7 families, including Bovidae (5), Canidae (1), Cercopithecidae (4), Felidae (1), Galagonidae (2), Orycteropodidae (1) and Suidae (2). Only nine species of primates and antelopes were encountered frequently enough for densities to be estimated. A total of 404 sightings from 40 counts were recorded, the majority being for blue monkey (34.9%) and Angolan colobus (26.0%). For galagos, 210 sightings from 58 counts were recorded, the majority being for Rondo galago (62.2%). Absolute density (individuals km^{-2}) (±SE) for blue monkey (125±28.8) was highest, followed by the Angolan colobus (74.0±3.9) and yellow baboon (33.6±8.1). Antelopes had much lower densities with that of suni (23.4±8.7) being the highest, followed by Harvey's red duiker (13.6±9.5), blue duiker (9.5±6.4) and bushbuck (2.3±0.5). Densities for the Rondo galago and Zanzibar galago were 23.4±9.1 and 12.9±10.5, respectively. Only one bushbuck pellet pile was encountered while for the two duikers and suni a total of 106 fresh pellet piles were counted. Relative pellet pile density (piles km^{-2}) for suni was 280.1±73.7, while for red duiker and blue duiker densities were 170.9±50.6 and 119.9±52.9, respectively. Endemic large mammals were not observed in the forest though six were forest specialists, one near endemic, six threatened and seven in the CITES list.

INTRODUCTION

Literature on large mammal counts in the eastern Africa coastal forests is scanty, as most previous surveys were biased towards listing the number of species in the forests (Clarke and Dickinson 1995) rather than their abundance. The only studies on density estimates are those by Mturi (1991) on the red colobus on Zanzibar Island, Swai (1983) and Williams *et al*. (1996) on the antelopes also on Zanzibar Island, Banda (1994) on ungulates and primates in Kisiju Forest and Struhsaker and Oates (1979) and Rodgers (1981) on primates.

A total of 960 mammal species occur in sub-Sahara Africa (Wilson and Reeder 1993). Coastal forests of Somalia, Kenya and Tanzania support at least 158 mammal species. The most diverse species include bats (58), rodents (>27), carnivores (19), primates (14) and shrews (14) (Burgess *et al*. 2000). Thirty-one species in these forests are forest specialist and 109 species are generalists. The dominance of non-forest species in these forests is possibly because most of the forests are fragmented and degraded (Burgess *et al*. 2000).

The much larger equatorial rainforests harbour between 90-130 mammal species, the majority (70%) being forest specialists that are biased towards primates, bats, rodents and antelopes This contrasts with the situation in eastern Africa coastal forests where only 20% of the species are forest specialists. Only a few species, mostly bats, occur both in the coastal forests and the equatorial rainforests and none of the larger species occur in both types of forests. Affiliation between mammal species in the coastal forests and Eastern Arc forests is very close, especially for small mammals and galagos (Kingdon 1997).

Approximately one third of the 960 mammal species in sub-Saharan Africa are endemic to Africa and the remainder also

occur in Europe and Asia (Kingdon 1990). Only one large mammal species, Ader's duiker (*Cephalophus adersi*) is endemic to the eastern Africa coastal forests (Wilson and Reeder 1993) occurring only on Zanzibar Island and Arabuko-Sokoke forests in Kenya.

Despite the lower number of coastal forest specialist mammal species, endemism per unit area is higher than in the equatorial rainforests. Suggestions are that coastal forests have remnants of species which have become extinct further to the west or that the endemic mammals in the coastal forests have evolved since their separation from the western forest block (Burgess *et al*. 2000).

STUDY AREA AND METHODS

Study area

Zaraninge is a dry evergreen coastal forest, situated between $6^0$04': $6^0$13'S and $38^0$35': $38^0$42'E, in Bagamoyo District, northeastern Tanzania (Fig. 1). The forest covers about 20 km^2 on a plateau, which rises to an altitude of 300 m.a.s.l; surrounding it are several small patches of evergreen forests and thickets, before reaching mixed wooded grassland at the lowland of the plateau. Mean annual rainfall ranges between 900 and 1400 mm but its pattern is very variable (Clarke 2000). Short rains are received from October–February and long rains from April – August.

Kiwia (2005) described the vegetation of the forest; tree density was 328 trees ha^{-1}, basal area 19.9 m^2 ha^{-1} and crown cover 67.0%. The forest had three strata and average tree height of 15.0±0.5 m (range 5.0-30.0 m). The population structure showed a negative exponential curve, suggesting the forest was healthy and growing, with minimal anthropogenic disturbance. Fabaceae family and *Scorodophloeus fischeri* dominated the forest.

Sixteen large mammal species were sighted in the forest (Kiwia 2005), comprising six primates, seven ungulates, leopard (*Panthera pardus*) and aardvark (*Orycteropus afer*). Hunting dog (*Lycaon pictus*) a non-forest species was encountered only once.

METHODS

Dense vegetation cover imposes some difficulty in conducting density estimates for forest mammals. Therefore the line transect method (Whitesides *et al*. 1988) and faecal pellet pile counts (Koster and John 1988) were employed. Foot census was the only viable means of conducting the study due to the dense vegetation cover.

Line transect method

Ten parallel transect lines (Fig. 1) with a width of 1 m were demarcated in the forest at 500 m interval (E-W compass bearing along Mbwebwe – Tumbilini road) in order to avoid double counting the animals. Each transect was run by a recorder and an observer. Forest guards had good knowledge of the forest mammals, but they were first trained before participating in the surveys.

Antelopes and primates in the study area are cryptic and shy due to human disturbance therefore, surveys were conducted quietly and at a slow speed of about 1 km h^{-1} (Whitesides *et al*. 1988), stopping after every 50 m for about a minute to listen for animal or branch movements and vocalizations. Upon detection of an animal, information recorded included: a) species name b) number of individuals in a group - a group of primates was defined as all individuals within 50 m radius from the first individual sighted (Whitesides *et al*. 1988) and c) sighting (observer to animal) distance (m). All distances were estimated by eye and for primate groups; distance recorded was to the first animal seen (Butynski 1990). Forty counts were conducted on each transect amounting to a total transect length of 118.7 km.

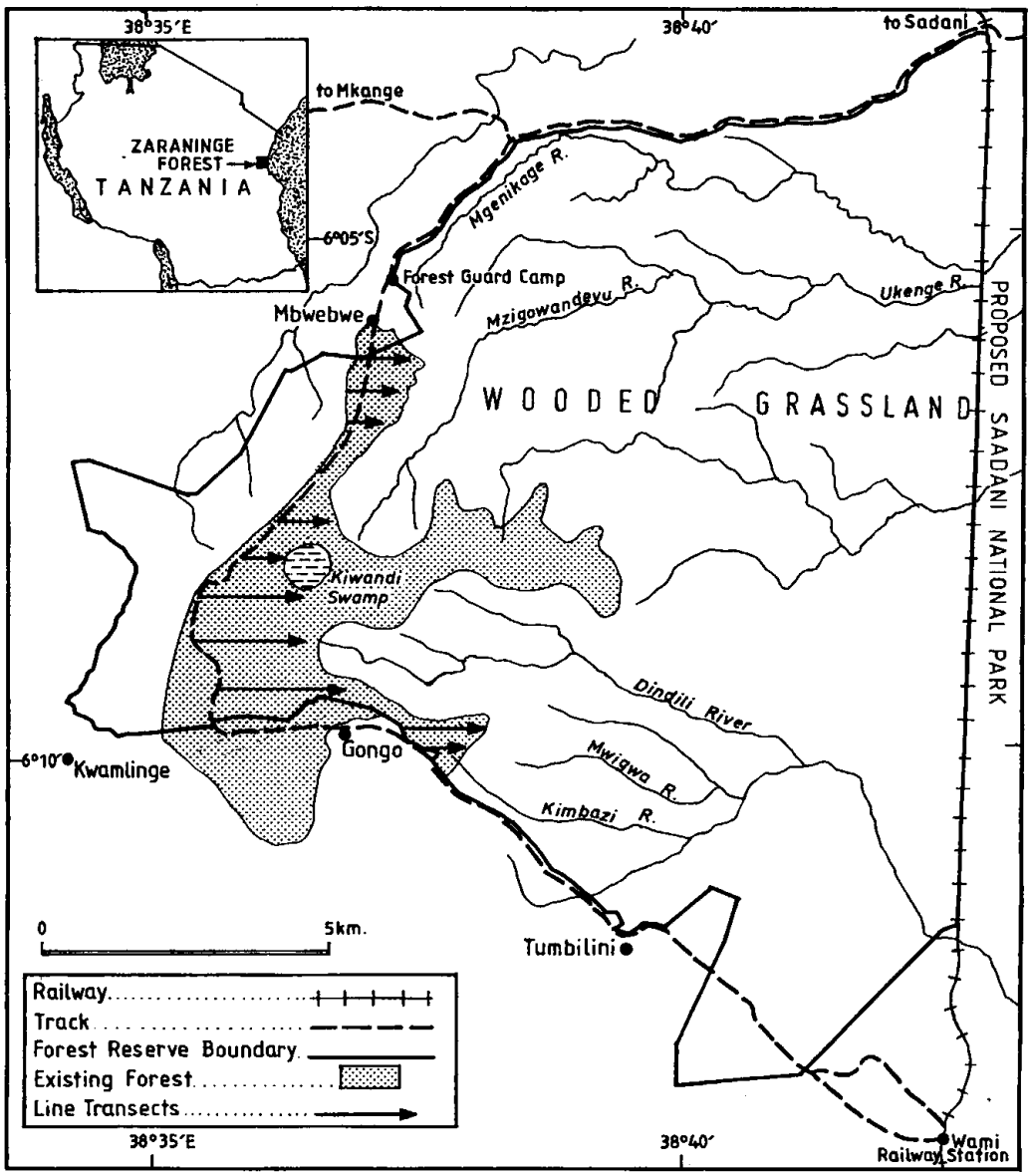

Figure 1: Map of Zaraninge Forest in northeastern Tanzania showing the dermacated transects lines used for thies study.

Galago spp. were mostly detected by vocalizations that are species-specific. Individuals close to transect lines could be seen using spotlights. Upon seeing an animal or hearing a call, information recorded included: a) species name b) number of individuals vocalizing at the spot and c) sighting distance (m). Counts were

conducted in the demarcated transects and along Mbwebwe – Gongo – Tumbilini main road. A total of 58 counts were conducted on a total transect length of 223.8 km.

Large mammals that could be counted directly included all primates and antelopes. Casually encountered species were only recorded. Forest antelopes (Bowland and Perrin 1995) and diurnal primates (Struhsaker 1975) have peak activity shortly after dawn and just before dusk. Thus, counts were conducted between 06.30 and 08.00 hrs and between 17.00 and 19.00 hrs so that they could be spotted easily (Struhsaker 1975). Both galago spp. were most active soon after sunset and just before dawn (Pers. Obs.); therefore they were counted between 19.30 and 21.00 hrs and 4.30 and 5.30 hrs.

Faecal pellet pile counts

Counts of faecal pellet piles (Koster and John 1988) were used to estimate relative densities of the small antelopes in the forest. Counts were conducted during the dry season of September so that fresh and old pellets could be distinguished. Forest duikers and suni usually deposit faecal pellets in discrete piles in their territories (Kingdon 1997). A few pellets from rectums of wild caught antelopes showed pellet size (length and width) and shape to be species specific; therefore it was possible to distinguish them in the field. Seven transects with a total length of 8.8 km were twice searched for pellet piles using an effective strip width of 20 m and surveys were conducted at a very slow speed by five observers to ensure that all piles were seen and counted.

Data analysis

Species richness was compiled from direct encounters, footprints, animal signs and information gathered from the local residents. Density (D=number of individuals km^{-1}) was calculated using the formula; $D = n_i / 2Lw$, where n_i = total number of individuals of species i, L = total length of transects and $2w$ = effective strip width; where w (reliable sighting distance) was determined by plotting the frequency distributions of sighting distances as described by Whitesides *et al*. (1988). Defler and Pintor (1985) also recommended the use of reliable sighting distances, especially for cryptic animals in habitats with poor visibility.

The relative density (D) for pellet piles was calculated using the formula; $D = n_i / Lw$, where n_i = number of pellet piles counted for species i, L = total length of transects and w = fixed strip width (20 m).

RESULTS AND DISCUSSION

Species richness

Table 1 shows a checklist of large mammals sighted in the forest. Sixteen species, in 13 genera and 7 families were recorded. Family Bovidae was the largest with five species followed by Cercopithecidae (4), Galagonidae (2), Suidae (2), and the remainder had one species each. Vervet monkeys (*Chlorocebus aethiops*) only utilized the forest edges.

Medellin (1994) recorded about 112-116 mammal species in undisturbed tropical rainforests. From nine Neotropical rainforests Medellin (1994) recorded a range of 70-116 species per forest and Tutin *et al*. (1997) observed 45 species of large to medium-sized mammals (>2 kg) from Lope rainforest in Gabon.

The four primate species in the Zaraninge Forest, account for 57.1% of the seven species found in the eastern Africa coastal forests (Burgess *et al*. 2000). The four species were also recorded in Kisiju Forest (Banda 1994). Jozani Forest on Zanzibar Island had only two (Mturi 1991) and Tana River delta five species (Muoria *et al*. 2003).

Mammal species richness primarily correlates with the amount of annual rainfall (Medellin 1994) and within a geographical

region, Reed and Fleagle (1995) also noted a high correlation between primate species richness and mean annual rainfall for South America and Madagascar. Kibale and Semliki rainforests in Uganda that receive high rainfall are amongst the richest in primate species in Africa, with eight species each. Tutin *et al*. (1997) also recorded eight primates from Central Africa.

Table 1: A checklist of large mammals in Zaraninge Forest, Coast Region, Tanzania.

FAMILY	Species		Common name
BOVIDAE	*Cephalophus monticola*	*	Blue duiker
	Cephalophus harveyi	*	Harvey's red duiker
	Neotragus moschatus	*	Suni
	Syncerus caffer	**	African buffalo
	Tragelaphus scriptus	*	Bushbuck
CANIDAE	*Lycaon pictus*	**	Hunting dog
CERCOPITHECIDAE	*Cercopithecus mitis*	*	Blue monkey
	Chlorocebus aethiops †	**	Vervet monkey
	Colobus angolensis	*	Angolan colobus
	Papio hamadryas	*	Yellow baboon
FELIDAE	*Panthera pardus*	**	Leopard
GALAGONIDAE	*Galagoides rondoensis*	*	Rondo galago
	Galagoides zanzibaricus	*	Zanzibar galago
ORYCTEROPODIDAE	*Orycteropus afer*	**	Aardvark
SUIDAE	*Phacochoerus africanus*	**	Warthog
	Potamochoerus porcus	**	Bush pig
Families = 7	**Genera=13; Species=16**		

Key: * = animals counted using the line transect method; ** = animals casually encountered; † = animal utilizing forest edges only.

On the other hand, in Africa, Struhsaker (1981) found the number of primate species in any tropical forest to be dependent on its proximity to the refuge (equatorial evergreen rainforests). Likewise, Rodgers *et al*. (1982) detected a linear gradient of species impoverishment in both Kenya and Tanzania forests relative to the distance from the refuge (both also relate to the amount of rainfall). That being analogous to the observation that the number of bird species on an island decreases with increasing distance from the continent or another large island which is the source of colonizing birds (Diamond 1975).

The four antelope species in the Zaraninge Forest, account for 36.4% of the eleven species found in the eastern Africa coastal forests (Burgess *et al*. 2000). On Zanzibar Island three species were recorded (Swai 1983, Williams *et al*. 1996) and two in Kisiju Coastal Forest (Banda 1994). This implies that Zaraninge is amongst the richest coastal forests in antelope species. In contrast, tropical rainforests are richer in antelope species than tropical dry forests. Udzungwa Mountain rainforest, which is the richest site in Tanzania for this group, harbours five species (Rodgers and Homewood 1982), Makokou evergreen rainforest in Gabon, eight species (Dubost 1979) and Lope rainforest also in Gabon, nine species (Tutin *et al*. 1997).

On major continental areas and islands, Reed and Fleagle (1995) also noted a positive correlation between the number of primate species and area of tropical forest, which conforms to the predictions of the MacArthur-Wilson Model (MacArthur and Wilson 1967). Similar relationships have

been reported for rainforest bats (Findley 1993) and mammals (Chiarello 2000). Therefore, the impoverishment in mammal species in the Zaraninge Forest can possibly be accounted for by its small size, low and unpredictable rainfall pattern and its long distance from the refuge (the equatorial evergreen rainforests).

Density estimates

A total of 404 sightings for primates and antelopes were recorded in the forest. Blue monkey had the highest frequency of sightings (34.9%) followed by Angolan colobus (26.0%). The least sighted species was the bushbuck (2.0%). From the 58 counts conducted on galagos, 210 sightings were recorded, the majority being for Rondo galago (62.2%). Table 2 shows the mean absolute density estimates (individuals km^{-2}) (±SE) for mammals in the forest. The Angolan colobus had a density of 74.0±3.9, compared to 125.6±28.8 and 33.6±8.1 for blue monkey and yellow baboon, respectively. Mean densities for the Rondo galago and Zanzibar galago were 23.4±9.1 and 12.9±10.5, respectively. The four antelopes had much lower densities. Suni had a density of 23.4±8.7, whereas red duiker, blue duiker and bushbuck had densities of 13.6±9.5, 9.5±6.4 and 2.3±0.5, respectively.

Table 2: Absolute density estimates for large mammals recorded in Zaraninge Forest, Coast Region, Tanzania.

Species	Sighting frequency	Number of individuals	Reliable sighting distance (m)	Mean density (km^{-2}) ±SE
Angolan colobus	105	644	50	74.0 ± 3.9
Blue monkey	141	1086	50	125.6 ± 28.8
Yellow baboon	16	176	30	33.6 ± 8.1
Harvey's red duiker	42	48	20	13.6 ± 9.5
Blue duiker	18	25	15	9.5 ± 6.4
Suni	74	82	20	23.4 ± 8.7
Bush buck	8	8	20	2.3 ± 0.7
Zanzibar galago	73	88	60	12.9 ± 10.5
Rondo galago	137	163	50	23.4 ± 9.1

Angolan colobus

The colobus density of 74.0 ±3.9 animals km^{-2} is lower than 144±SD=14 reported from Kisiju Coastal Forest by Banda (1994) but higher than the density reported by Decker (1994) in Magombero Forest (9.0 animals km^{-2}) and by Rodgers and Homewood (1982) in Mwanihana Forest (10-11.0 animals km^{-2}). Reasons for the low densities recorded in Magombera and Mwanihana Forests could be threefold: Firstly, counting methods were different, secondly, poaching in Mwanihana Forest and thirdly, degradation of Magombera Forest during the construction of the TAZARA railway line and encroachment for agriculture. Poaching in the Zaraninge Forest was not observed whereas in Mwanihana and most other tropical forests, primates are killed for their skin or meat (Rodgers and Homewood 1982, Decker 1994).

Within the African Colobinae, only the red colobus seems to achieve higher densities (Altmann 1979). Densities for *C. badius kirkii* on Zanzibar Island were exceptionally high, especially in a farmland (rich in food resource) adjacent to Jozani Forest where a density of 550 animals km^{-2} was recorded and from Jozani Forest itself a density of

235.0 animals km^{-2} (Kirstin and Struhsaker 1999).

Blue monkey
The density for blue monkey (125.6±40.7 animals km^{-2}) in Zaraninge, was a bit higher than that of 91.0, SD=10.3 animals km^{-2} reported in Kisiju Forest (Banda 1994) but quite higher than a density of 73.0 animals km^{-2} in the dry tropical forest in Amboseli National Park (Altmann *et al*. 1985). Higher densities have been recorded in tropical rainforests, possibly due to the availability of food throughout the year. Aldrich-Blake (1979) recorded a density of 182.7 animals km^{-2} in Budongo Rainforest, Uganda, and Cords (1987) recorded 169.0 animals km^{-2} in Kakamega Rainforest.

Yellow baboon
The mean baboon density of 33.6±11.5 animals km^{-2} obtained in this study compares well with the densities of 26.0 animals km^{-2} reported by Devore (1979), 10.2-23.9 animals km^{-2} in Eritrea (Zinner *et al*. 2001) and 26.0 animals km^{-2} in Ethiopia Bole Valley (Dunbar and Dunbar 1974).

Blue duiker
The blue duiker density in the Zaraninge Forest of 5.4± 3.7 animals km^{-2}, is consistent with densities of 3.1 animals km^{-2} reported by Swai (1983) in Jozani Forest, and 8.3±8.3 and 15±11.2 animals km^{-2} reported by Williams *et al*. (1996) in the same forest and 6.1 animals km^{-2} from Lope Forest fragments in Gabon by Tutin *et al*. (1997).

In the Zaraninge forest, duikers were often found in or near tangled undergrowth vegetation that dominated tree fall gaps. Williams *et al.* (1996) also obtained highest densities from the high thickets (41.7±11.2) and secondary thickets (34.1±10.3) on Zanzibar Island, suggesting thickets to be most preferred habitat by the species. In Kibale rainforest duikers also seemed to prefer selectively felled forest (Nummelin 1990) and in Lope Reserve, forest fragment edges (Tutin *et al*. 1997).

Harvey's red duiker
Literature on the density of Harvey's red duiker is lacking but if comparison with the density of Ader's duiker is considered, then the result obtained in this study of 13.6±9.5 animals km^{-2} compares well with that reported by Williams *et al*. (1996) of 9.4±3.87 animals km^{-2} on Zanzibar Island thickets.

B*ushbuck*
Records on bushbuck density estimates vary considerably, possibly because the species occur in a variety of habitats (Kingdon 1997) and also due to the different sampling methods. The density in this study of 2.3±0.5 animals km^{-2} supports earlier observation by Titun *et al*. (1997), in Lope Rainforest, Gabon, where bushbuck occurred at a low density of 1.4 animals km^{-2}. In contrast, Banda (1994) and Waser (1975) using the same census method, respectively, recorded densities of 13.0 SD=1.59 in Kisiju Forest and 9.0 animals km^{-2} at Mweya Peninsular, Uganda. However, counting known individuals in the same study area, Waser (1975) recorded a density of 26.0 animals km^{-2} and Allsopp (1978) a density of 30.1 animals km^{-2} in Nairobi National Park.

Bushbuck is predominantly a browser, but it also grazes on young green grass (Dankwa-Wideru and Euler 2002). Therefore, the only suitable area for the animal in the Zaraninge Forest was Kiwandi swamp, which is not only small (2.5 km^{2}) but also dries up during the dry season; thus it cannot support a large bushbuck population. Preferred habitat for the species in Gabon was savannas surrounding forest patches (Tutin *et al*. 1997), bushland at Mweya peninsular (Waser 1975) and open wooded grassland in Nairobi National Park (Allsopp 1978). This suggests that continuous forest like Zaraninge cannot harbour large populations of the species due to food scarcity.

Zanzibar and Rondo galagos
Records on densities of these two species are lacking in the literature. In the present study, densities of 12.9±10.5 and 23.4±9.1 were respectively obtained for Zanzibar and Rondo galagos.

Faecal pellet pile density
Only a single bushbuck pellet pile was recorded. A total of 106 fresh faecal pellet piles for the remaining three antelopes were counted. Pellet pile density (piles km^{-2}) (±SE) for suni was 280.1±73.7, followed by Harvey's red duiker (170.9±50.6) and blue duiker (119.9±52.9). The trend for the relative density estimates for these antelopes compare well with the absolute densities obtained from the line transect method. Both methods show suni density to be highest, followed by that of Harvey's red duiker and the lowest being that of the blue duiker.

Mammal species of conservation importance
Table 3 shows the forest specialist, endemic, threatened and species in CITES list.

Table 3: Large mammal species that are forest specialist, endemic, threatened and in CITES list in Zaraninge Forest, Coast Region, Tanzania.

FAMILY	Species	FS	En	Th	CITES
BOVIDAE					
	Blue duiker	+	-	-	II
	Harvey's red duiker	+	-	LR/cd	-
	Suni	-	-	LR/cd	-
	African buffalo	-	-	LR/cd	-
CERCOPITHECIDAE	Blue monkey	+	-	-	II
	Angolan colobus	+	-	DD	II
	Yellow baboon	-	-	-	II
GALAGONIDAE	Rondo galago	+	-	EN	II
	Zanzibar galago	+	**	LR/ nt	II
FELIDAE	Leopard	-	-	-	I
TOTALS		**6**	**1**	**6**	**7**

Key:
FS=Forest Specialist; Th=Threatened; En=Endemic; EN=Endangered; LR= Lower risk; DD=Data deficient; cd=conservation dependent; nt=near threatened; ** Near-endemic- in coastal and Eastern Arc forests; I, II, are CITES appendices. Source: Hilton-Taylor (2000); CITES (2001); Burgess *et al*. (2000).

Forest specialist species
There are six forest specialist species in the Zaraninge Forest; namely, Angolan colobus, blue monkey, Zanzibar and Rondo galagos, Harvey's red duiker and blue duiker.

Endemic species
There was no mammal species specifically endemic to the Zaraninge Forest, and there is no mammal species endemic to a single forest locality in East Africa (Rodgers and Homewood 1982). The Zanzibar galago is near endemic as it occurs in coastal and Eastern Arc Forests (Burgess *et al*. 2000).

Threatened species
Six species are in the IUCN Red List of threatened species (Hilton-Taylor 2000), comprising the Angolan colobus that is listed under DD, Rondo galago (EN), Zanzibar galago (LR/nt). Harvey's red duiker, suni and African buffalo are all listed under Low risk (LR/cd).

CITES species
Seven species are in the Checklist of CITES species (CITES 2001), including the leopard in Appendix I and blue duiker, blue monkey, Angolan colobus, yellow baboon, Rondo galago and Zanzibar galago in Appendix II.

In the eastern Africa coastal forests, there are about 31 mammal species that are forest specialists, four being endemic (bats excluded) and nine being threatened (Burgess *et al*. 2000). Conservation of these mammals, especially the forest specialist species, deals essentially with the conservation of their habitat, the forest ecosystems (Struhsaker 1981).

Species most susceptible to effects of fragmentation include habitat specialist mammals (Laurance 1990) that are incapable of inter-patch migration (Noss 1987) and species with large home ranges (Terborgh 1974). Most primates and some antelopes are adapted to life in undisturbed forest, being incapable of surviving in non-forest habitats. These species are all threatened to some extent by the rapid rate of forest destruction, in addition of being isolated from one another by agricultural land (Struhsaker 1981, Chiarello and de Melo 2001). The impact of the loss of habitat and fragmentation coupled with edge effects (Young and Mitchell 1993) in the patches of vegetation that remain are considered by many scientists as major factors contributing to the loss of biodiversity worldwide (Laurance 1999).

Coastal forests in Tanzania were more extensive in the past, but due to uncontrolled anthropogenic activities only small patches ranging in size from 1 to 50 ha remain (Burgess *et al*. 2000) that serve as refuge for the forest specialist, endemic and threatened species. Some of these forests, being too small, over-exploited and isolated are extremely vulnerable and are unlikely to be able to conserve viable populations of primates and the other large mammals (Struhsaker 1981). According to Burgess *et al*. (2000), it is possible some species have locally disappeared from these coastal forests patches due to their small size.

However, Struhsaker (1981) and Sayer and Whitmore (1991), observed the relationship between forest loss and species loss not to be linearly related, although species persisting as isolated populations in relatively small-protected areas are already predisposed to eventual extinction. Newmark (1996) also found the rate of extinction of mammals in six parks over the past 35-83 years to be significantly and negatively related to park area, suggesting that insularization of parks has been a major factor in the large mammal extinction, and the loss will probably continue, particularly in the smaller parks.

For the very small patches (2-5 km^2), probably all or most of the forest specialist species that require large home ranges have already become locally extinct, due to the small size of the patches (Yahner 1988). It

has also been observed in birds that long-distance migrants and forest interior species were poorly represented in small forest patches (Blake and Karr 1984).

The Zaraninge Forest is small but surrounded by several smaller forest parches where inter-patch migration is possible. The forest is now part of Saadani National Park therefore; further encroachment by the local population is not expected. The degree of threat to the forest specialist mammals depends primarily on the size of the forest and the species requirements. The primates and small antelopes require small home ranges and they also utilize the surrounding forest patches, therefore if poaching and wild fires from the woodland are controlled, populations of these species will increase and hopefully they will not be expected to become extinct in the near future.

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